Section 2

Forests and Fisheries

Reading Preview

Key Concepts

- How can forests be managed as renewable resources?
- How can fisheries be managed for a sustainable yield?

Key Terms

- clear-cutting
- selective cutting
- sustainable yield
- fishery
- aquaculture

Target Reading Skill

Using Prior Knowledge Before you read, write what you know about forests and fish resources in a graphic organizer like the one below. As you read, write what you learn.

What You Know
1. Forests provide people with lumber and paper. 2.

What You Learned
1. 2.

Lab zone Discover Activity

What Happened to the Tuna?

1. Use the data in the table to make a line graph. Label the axes of the graph and add a title. (To review graphing, see the Skills Handbook.)
2. Mark the high and low points on the graph.

Think It Over

Inferring Describe the changes in the tuna population during this period. Can you suggest a reason for these changes?

Year	Western Atlantic Bluefin Tuna Population
1970	218,000
1975	370,000
1980	67,000
1985	58,000
1990	46,000
1995	63,000
2000	67,000

At first glance, an oak tree and a bluefin tuna may not seem to have much in common. One is a plant and the other is an animal. One lives on land and the other lives in the ocean. However, oak trees and tuna are both living resources. People use oak trees to make furniture, lumber, and cork. Tuna are a source of food for people.

Every day you use many different products that are made from living organisms. In this section, you will read about two major types of living resources: forests and fisheries.

Forest Resources

Forests contain many valuable resources. Many products are made from the fruits, seeds, and other parts of forest plants. Some of these products, such as maple syrup, rubber, and nuts, come from living trees. Other products, such as lumber and wood pulp for making paper, require cutting trees down. Coniferous trees, including pine and spruce, are used for construction and for making paper. Hardwoods, such as oak, cherry, and maple, are used for furniture because of their strength and beauty.

Trees and other plants produce oxygen that organisms need to survive. They also absorb carbon dioxide and many pollutants from the air. Trees help prevent flooding and control soil erosion. Their roots absorb rainwater and hold the soil together.

◀ Newspapers ready for recycling

Lab zone Discover Activity

Skills Focus Inferring

Materials graph paper, ruler, pencil

Time 15 minutes

Tips In Step 1, advise students to use *Population (in thousands)* as the vertical axis and *Year* as the horizontal axis.

Expected Outcome Students' graphs should reflect data in the table.

L2

Think It Over The tuna population increased from 1970 to 1975, and then declined steadily from 1975 to 1980. From 1980 until today the population has remained about the same. The decline may have been due to overfishing of tuna. The stabilization may have resulted from limits on tuna fishing.

Section 2

Forests and Fisheries

Objectives

After this lesson, students will be able to

E.3.2.1 Describe how forests can be managed as renewable resources.

E.3.2.2 Describe how fisheries can be managed for a sustainable yield.

Target Reading Skill

Using Prior Knowledge Explain that using prior knowledge helps students connect what they already know to what they are about to read.

Answers

Possible answers:

What You Know

1. Forests provide people with lumber and paper.

2. Commercial fishing boats harvest large amounts of fish.

What You Learned

1. Forests can be renewable resources.

2. Setting fishing limits, changing fishing methods, and developing aquaculture techniques are ways to manage fisheries for sustainable yields.

All in One Teaching Resources

- Transparency E24

Preteach

Build Background Knowledge

L1

Identifying Forest Products

Invite students to look around the classroom. Ask: **What are some of the things made from trees in this classroom?** *(Examples include writing paper, cardboard, poster board, paper towels, textbooks, wood furniture, pencils, and chairs.)*

Instruct

Forest Resources

Teach Key Concepts L2

Importance of Forests

Focus Remind students that forests are valuable resources.

Teach Ask: **What are some products that come from forests?** *(Possible answers: Nuts, lumber, rubber, fruits, pulp for paper)*

Apply Ask: **Why else are forests important?** *(Plants there produce oxygen, absorb pollutants, help prevent flooding, and control soil erosion.)* **learning modality: verbal**

Managing Forests

Teach Key Concepts L2

Logging Methods

Focus Direct students' attention to Figure 3.

Teach Ask: **How can you describe the old-growth forest after clear-cutting?** *(No trees are left in the area that was clear-cut.)* **How can you describe the forest after selective cutting?** *(There is a mix of trees remaining.)*

Apply Ask: **Which final stage—replanted growth or diverse growth—is more like the original old-growth forest?** *(Diverse growth)*

Extend Ask: **Do you think you can replace an old-growth forest? Explain.** *(Students probably will recognize that they could replant trees, but not the original forest; the forest ecosystem will have been permanently altered even if selective cutting is used.)* **learning modality: visual**

All in One Teaching Resources

- Transparency E25

Independent Practice L1

All in One Teaching Resources

- Guided Reading and Study Worksheet: *Forests and Fisheries*

Student Edition on Audio CD

Go Online active art

For: Logging Methods Activity
Visit: PHSchool.com
Web Code: cep-5032

Students can compare two methods of logging: clear-cutting and selective cutting.

Go Online active art

For: Logging Methods activity
Visit: PHSchool.com
Web Code: cep-5032

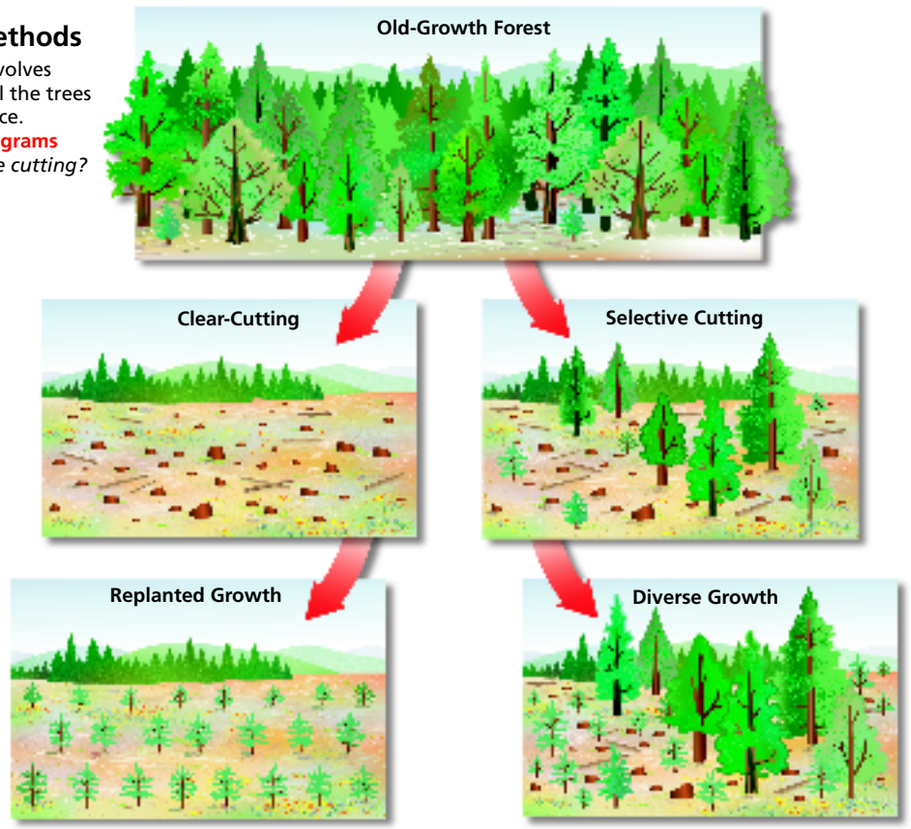
Managing Forests

There are about 300 million hectares of forests in the United States. That's nearly a third of the nation's area! Many forests are located on public land. Others are owned by individuals or by private timber and paper companies. Forest industries in the United States provide jobs for more than 1 million people.

Because new trees can be planted to replace trees that are cut down, forests can be renewable resources. The United States Forest Service and environmental organizations work with forestry companies to conserve forest resources. They try to develop logging methods that maintain forests as renewable resources.

Logging Methods There are two major methods of logging: clear-cutting and selective cutting. **Clear-cutting** is the process of cutting down all the trees in an area at once. Cutting down only some trees in a forest and leaving a mix of tree sizes and species behind is called **selective cutting.**

FIGURE 3
Logging Methods
Clear-cutting involves cutting down all the trees in an area at once.
Interpreting Diagrams
What is selective cutting?



Differentiated Instruction

Special Needs L1

Three-Dimensional Models Students with visual impairments may have difficulty distinguishing the images in Figure 3. Prepare the following three-dimensional models. Insert wooden dowels of various lengths into clay to represent an old-growth forest. Prepare four other models with clay and dowels to represent the other images. Then pair students with visual impairments with sighted students to discuss the processes of clear-cutting and selective cutting. **learning modality: kinesthetic**

Each logging method has advantages and disadvantages. Clear-cutting is usually quicker and cheaper than selective cutting. It may also be safer for the loggers. In selective cutting, the loggers must move the heavy equipment and logs around the remaining trees in the forest. But selective cutting is usually less damaging to the forest environment than clear-cutting. When an area of forest is clear-cut, the ecosystem changes. After clear-cutting, the soil is exposed to wind and rain. Without the protection of the tree roots, the soil is more easily blown or washed away. Soil washed into streams may harm the fish and other organisms that live there.

Sustainable Forestry Forests can be managed to provide a sustainable yield. A **sustainable yield** is an amount of a renewable resource such as trees that can be harvested regularly without reducing the future supply. Sustainable forestry works sort of like a book swap: as long as you donate a book each time you borrow one, the total supply of books will not be affected. Planting a tree to replace one that was cut down is like donating a book to replace a borrowed one.

In sustainable forestry, after trees are harvested, young trees are planted. Trees must be planted frequently enough to keep a constant supply. Different species grow at different rates. Forests containing faster-growing trees, such as pines, can be harvested and replanted every 20 to 30 years. On the other hand, some forests containing hardwood trees, such as hickory, oak, and cherry, may be harvested only every 40 to 100 years. One sustainable approach is to log small patches of forest. This way, different sections of forest can be harvested every year.

Certified Wood The Forest Stewardship Council is an international organization dedicated to sustainable forest management. This organization oversees certification of forests that are well managed and provide good working conditions for workers. Once a forest is certified, its wood may carry a "well-managed" label. This label allows businesses and individuals to select wood from forests that are managed for sustainable yields.

Reading Checkpoint **What is a sustainable yield?**

FIGURE 4
Sustainable Forestry
Sustainable forestry practices include the planting of young trees after mature trees have been harvested.

Lab zone **Build Inquiry** L2

Shelterwood Cutting

Materials 20 green, brown, red, and yellow plastic chips per group

Time 10 minutes

Focus Tell students that shelterwood cutting removes all the mature trees in an area at specified time intervals.

Teach Explain that shelterwood cutting occurs in three stages. At stage one, all unwanted trees are removed. Then remaining trees are allowed to grow and seedlings establish themselves. During stage two, many mature trees are removed and the forest is again left alone to grow. At stage three, the remaining mature trees are cut down. By this time, the seedlings have grown into young trees and more new seedlings are growing.

Apply Challenge small groups of students to develop a model of shelterwood cutting. *(Sample model: Use green plastic chips to represent mature trees and brown chips to represent unwanted trees. First stage: Remove all brown chips, leave green chips, add red chips (seedlings). Second stage: Remove some green chips, replace red chips with yellow chips (young trees), and add more red chips (seedlings). Third stage: Remove remaining green chips, replace yellow chips with green chips, replace red chips with yellow chips, and add more red chips.)* Ask: **How does the model illustrate that shelterwood cutting provides a sustainable yield?** *(The forest constantly replenishes itself.)* **learning modality: kinesthetic**

Monitor Progress L2

Skills Check Have pairs of students construct a table comparing the advantages and disadvantages of clear-cutting and selective cutting.

Answers

Figure 3 Selective cutting is the practice of cutting down only some of the trees in a forest and leaving a mix of tree sizes and species behind.

Reading Checkpoint An amount of a renewable resource that can be regularly harvested without reducing the future supply

Fisheries

Teach Key Concepts L2

Managing Fish Populations

Focus Tell students that fisheries are renewable resources.

Teach Ask: **How can people manage fisheries for a sustainable yield?** *(Setting fishing limits, changing methods, developing aquaculture techniques, and finding new resources)* **How can setting limits on the size of fish that can be caught help maintain fish populations?** *(Young fish will be more likely to survive and reproduce.)* **What are some fishing methods that have been outlawed? Why?** *(Poisoning fish or exploding dynamite underwater are outlawed because they harm all the fish in the area.)*

Apply Ask: **What steps do you think scientists might take to convince the public to eat new species of fish?** *(Answers might include educating the public about the new species and the need to find new sources for food, and convincing chefs to introduce new species.)* **learning modality: logical/ mathematical**

Lab zone Skills Activity

Calculating

In a recent year, the total catch of fish in the world was 112.9 million metric tons. Based on the data below, calculate the percent of this total each country caught.

Country	Catch (millions of metric tons)
China	24.4
Japan	6.8
United States	5.6
Peru	8.9

Fisheries

An area with a large population of valuable ocean organisms is called a **fishery.** Some major fisheries include the Grand Banks off Newfoundland, Georges Bank off New England, and Monterey Canyon off California. Fisheries like these are valuable renewable resources.

Until recently, fisheries seemed like an unlimited resource. The waters held such huge schools of fish. And fish reproduce in incredible numbers. A single codfish can lay as many as 9 million eggs in a single year! But people have discovered that this resource has limits. After many years of big catches, the number of sardines off the California coast suddenly declined. The same thing happened to the huge schools of cod off the New England coast. What caused these changes?

The fish were caught faster than they could breed, so the population decreased. This situation is known as overfishing. Scientists estimate that 70 percent of the world's major fisheries have been overfished. But if fish populations recover, a sustainable yield can again be harvested. **Managing fisheries for a sustainable yield includes strategies such as setting fishing limits, changing fishing methods, developing aquaculture techniques, and finding new resources.**

Fishing Limits Laws can ban the fishing of certain species. Laws may also limit the number or size of fish that can be caught or require that fish be within a certain range of sizes. These laws ensure that young fish survive long enough to reproduce and that all of the largest adult fish aren't caught. If a fishery has been severely overfished, however, the government may ban fishing completely until the populations recover.

FIGURE 5
Fisheries
Even though fisheries are renewable resources, they must be managed for sustainable yields, or the supply of fish may run out.

Lab zone Skills Activity

Skills Focus Calculating

Materials calculator

Time 5 minutes

Tips Review with students the steps needed to find percent and the conversion of a decimal value to a percent.

L1 **Expected Outcome** China: 24.4 ÷ 112.9 = .216 or 21.6%; Japan: 6.0%; United States: 5.0%; Peru: 7.9%

Extend Challenge students to develop a way to compare the percentages visually. *(Students may produce a circle graph or bar graph.)* **learning modality: logical/ mathematical**

Fishing Methods Today many fishing crews use nets with a larger mesh size that allow small, young fish to escape. In addition, many other fishing practices are regulated by laws. Some fishing methods have been outlawed. These methods include poisoning fish with cyanide and stunning them by exploding dynamite underwater. These techniques harm all the fish in an area rather than targeting certain fish.

Aquaculture The practice of raising fish and other water-dwelling organisms for food is called **aquaculture.** The fish may be raised in artificial ponds or bays. Salmon, catfish, and shrimp are farmed in this way in the United States.

However, aquaculture is not a perfect solution. The artificial ponds and bays often replace natural habitats such as salt marshes. Maintaining the farms can cause pollution and spread diseases into wild fish populations.

New Resources Today about 9,000 different fish species are harvested for food. More than half the animal protein eaten by people throughout the world comes from fish. One way to help feed a growing human population is to fish for new species. Scientists and chefs are working together to introduce people to deep-water species such as monkfish and tile fish, as well as easy-to-farm freshwater fish such as tilapia.

FIGURE 6
Aquaculture
Aquaculture is helping to meet the demand for fish. This fish farm in Hawaii raises tilapia.
Applying Concepts *What costs and benefits does aquaculture involve?*

Reading Checkpoint **What is aquaculture?**

Section 2 Assessment

Target Reading Skills **Using Prior Knowledge** Review your graphic organizer and revise it based on what you just learned in the section.

Reviewing Key Concepts

1. a. **Reviewing** Why are forests considered renewable resources?
   b. **Comparing and Contrasting** How does the clear-cutting logging method differ from selective cutting?
   c. **Developing Hypotheses** You are walking in a clear-cut section of forest a few days after a heavy rainstorm. A nearby stream is very muddy and has many dead fish. What might have happened?
2. a. **Listing** What are four ways fisheries can be managed for a sustainable yield?
   b. **Explaining** What are two kinds of laws that regulate fishing? How can they help ensure the health of a fishery?
   c. **Predicting** What might happen to a fish population over time if all the largest fish in the population were caught? Explain.

Lab zone At-Home Activity

Renewable Resource Survey With a family member, conduct a "Forest and Fishery" survey of your home. Make a list of all the things that are made from either forest or fishery products. Then ask other family members to predict how many items are on the list. Are they surprised by the answer?

Lab zone At Home Activity

Renewable Resource Survey L1
Encourage students to look beyond the most obvious products, such as wood and paper from forests, and salt and seafood from the ocean. Tell them to check labels closely to see if they can find the names of other items. Examples include nuts, spices, tree bark for mulch, and seaweeds.

Monitor Progress L2

Answers
Figure 6 Aquaculture provides a much-needed food source. Artificial ponds and bays built for aquaculture often replace natural habitats, and maintaining the farms can cause pollution and spread diseases into natural populations.

Reading Checkpoint Aquaculture is the practice of raising fish and other water-dwelling organisms for food.

Assess

Reviewing Key Concepts

1. a. Because new trees can be replanted to replace cut-down trees, forests are considered renewable resources. **b.** During clear-cutting, the entire tree growth in an area is removed. During selective cutting, trees of a particular species and/or size are removed while other trees remain. **c.** Possible answer: Without tree roots to hold water and soil in place, large amounts of soil were washed into the stream during the rainstorm. The soil in the water has made it more difficult for fish and other aquatic organisms to live.
2. a. Fishing limits can be imposed; fishing methods can be changed; aquaculture can replace catching of wild fish; new resources can be found. **b.** Laws may limit the species, number, and size of fish that can be caught. Fishing methods can be regulated. Laws allow the fish population to reproduce and maintain its size. **c.** If all the largest fish in a region are caught, the average size of the fish may become smaller over time.

Reteach L1
Have students use Figure 3 to explain how overfishing and clear-cutting are similar and how they are different.

Performance Assessment L2
Call on students at random to name a way to conserve forests or fisheries. Evaluate students' understanding of managing resources for sustainable yield.

All in One Teaching Resources
- Section Summary: *Forests and Fisheries*
- Review and Reinforcement: *Forests and Fisheries*
- Enrich: *Forests and Fisheries*

Tree Cookie Tales

L2

Prepare for Inquiry

Skills Objectives

After this lab, students will be able to

- observe growth rings in a tree cookie
- infer a tree's age from the growth rings
- use their growth ring data to interpret why rings might be narrower some years than others

Prep Time 15 minutes

Class Time 40 minutes

All in One Teaching Resources

- Lab Worksheet: *Tree Cookie Tales*

Advance Planning

Purchase or prepare a tree cookie for each student group. Inexpensive classroom sets of tree cookies are available from biological supply houses. Tree cookies should come from trees that were more than 10 years old. You can make tree cookies by sawing a tree trunk into cross sections 1.5–2.5 cm thick. To preserve homemade tree cookies, spray or paint all surfaces with clear polyurethane or other clear sealant.

Guide Inquiry

Invitation

Point out the picture of the tree cookie and have students read its labels. Ask: **What can you learn from observing a tree cookie?** *(Sample answer: The age of the tree when it was cut down)*

Introducing the Procedure

Before students begin, clarify that a single year's growth is shown by a pair of rings—a light ring for spring and a dark ring for summer.

Troubleshooting the Experiment

When students have counted the number of annual rings, do a spot check to ensure that students have recognized that an annual ring is made up of a pair of rings, one light and one dark.

Expected Outcome

Results will vary depending on the particular tree cookie used.

Analyze and Conclude

1. Ages will vary. The tree's age is equal to the number of annual rings.

2. The largest proportion of tree growth usually occurs during a tree's early years.

3. Observations may vary. Spring rings are usually wider because trees undergo a burst of new growth in the spring when it is usually wetter. This is followed by slower growth in summer, when it is usually drier.

4. Growth rings reflect weather conditions. Generally, rings are wider during warmer years and when rainfall is plentiful.

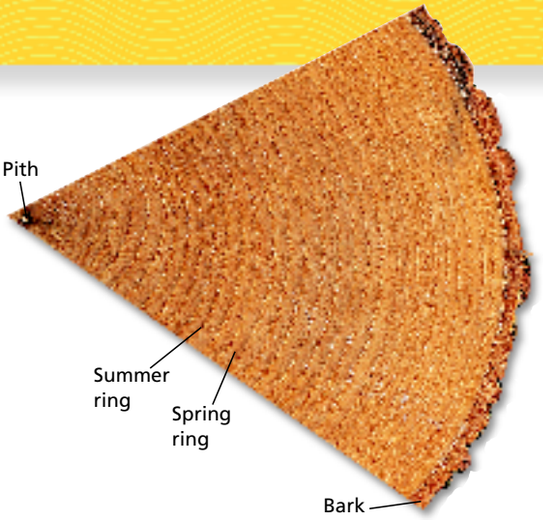
5. In addition to the tree's age and weather-related growth patterns, students may note holes made by insects or birds, blackening due to fire or lightning, a hollow pith due to disease, or cracks and gashes from tools.

Extend Inquiry

Design an Experiment Students' plans should be similar to the lab procedure. Have students share their results.

Lab zone Skills Lab

Tree Cookie Tales



Problem

What can tree cookies reveal about the past? A tree cookie is a slice of a tree trunk that contains clues about the tree's age, past weather conditions, and fires that occurred during its life.

Skills Focus

observing, inferring, interpreting data

Materials

- tree cookie
- metric ruler
- hand lens
- colored pencils
- calculator (optional)

Procedure

1. Your teacher will give you a "tree cookie." Use a hand lens to examine your tree cookie. Draw a simple diagram of your tree cookie. Label the bark, tree rings, and center, or pith.
2. Notice the light-colored and dark-colored rings. The light ring results from fast spring-time growth. The dark ring, where the cells are smaller, results from slower summertime growth. Each pair of light and dark rings represents one year's growth, so the pair is called an annual ring. Observe and count the annual rings.
3. Compare the spring and summer portions of the annual rings. Identify the thinnest and thickest rings.
4. Measure the distance from the center to the outermost edge of the last summer growth ring. This is the radius of your tree cookie. Record your measurement.
5. Measure the distance from the center to the outermost edge of the tenth summer growth ring. Record your measurement.
6. Examine your tree cookie for any other evidence of its history, such as damaged bark or burn marks. Record your observations.

Analyze and Conclude

1. **Inferring** How old was your tree? How do you know?
2. **Calculating** What percent of the tree's growth took place during the first ten years of its life? (*Hint:* Divide the distance from the center to the tenth growth ring by the radius. Then multiply by 100. This gives you the percent of growth that occurred during the tree's first ten years.)
3. **Observing** How did the spring rings compare to the summer rings for the same year? Suggest a reason.
4. **Interpreting Data** Why might the annual rings be narrower for some years than for others?
5. **Communicating** Using evidence from your tree cookie, write a paragraph that summarizes the history of the tree. Be sure to include as much detail as possible in your summary.

Design an Experiment

Suppose you had cookies from two other trees of the same species that grew near your tree. Write a plan for verifying the interpretations you made in this lab. *Obtain your teacher's permission before carrying out your investigation.*